Appendix F
Air Quality and Noise

F.1 AIR QUALITY

This appendix provides detailed data that support air quality impact assessments addressed in Chapter 3, Affected Environment-Air Quality and Chapter 4, Environmental Consequences-Air Quality. The data presented include emission inventories for site-related activities and facility emissions for various alternatives. Section F.1.1 presents the methodology and models used in the air quality assessment. Section F.1.2 presents supporting data applicable to each site. Sections F.1.2.2 through F.1.2.9 contain tables of site-specific information applicable to the air quality assessments at each site and figures showing wind rose data specific to each site. Section F.1.3 presents the emission rates for the facilities considered for each alternative. Section F.2 presents sound level monitoring data for each site and summarizes relevant local noise regulations.

F.1.1 METHODOLOGY AND MODELS

The assessment of potential impacts to air quality is based upon comparison of proposed project effects with applicable standards and guidelines. The Industrial Source Complex Short-Term Model Version 2 (ISCST2) is used to estimate concentrations of pollutants from emission sources at each site. The screening model (SCREEN2) is used to estimate concentrations of pollutants at the site boundary for the generic sites, assuming a distance to the site boundary of 800 meters (m) (0.5 miles [mi]).

The air quality modeling analysis performed for the candidate sites is considered a "screening level" analysis. It applies conservative assumptions to each site to permit comparison among the sites of the impacts associated with the respective alternatives. These conservative assumptions will tend to overestimate pollutant concentrations at each site.

The assumptions applied to the air quality analysis at each site are as follows: where available, existing modeling analyses of criteria pollutant and toxic/hazardous pollutant emissions were used to determine No Action concentrations and are based on actual source locations and stack parameters; criteria pollutant and toxic/hazardous pollutant emissions were modeled for other sites and each alternative from a single source centrally located within the complex of facilities on each site assuming a 10-m (32.8-foot [ft]) stack height, a 0.3-m (1-ft) stack diameter, stack exit temperature equal to ambient temperature, and a stack exit velocity equal to 0.03 m/second (s) (0.1 ft/s) unless otherwise specified. These assumptions will tend to overestimate pollutant concentrations because they do not account for spacial and temporal variations of emission sources.

Emission sources at each facility or site and for each alternative were assumed to be in the same location as existing toxic/hazardous pollutant emission sources and assumed the modeling parameters used for those emissions.

The ISCST2 model is a revision of the ISCST model. The modeling algorithms have not been changed and the revised model will give nearly identical results to the original ISCST model for most applications. The performance of the ISCST model has not been validated with field data. However, it is an extended version of a single-stack model, CRSTER, that has been examined using field data from four large power plants. The performance of the ISCST model has been evaluated with field data for its point source submodel and for its special features, such as the gravitational settling/dry deposition option and building downwash option. From the validation studies for the single source CRSTER model, based on field data measured at four large power plants, it was concluded that the model acceptably predicts the upper percentile of the corresponding distributions of 1-hour concentrations and of the corresponding distributions of 24-hour concentrations. The highest-second-highest (a term within the model to represent the second highest concentration) 1-hour concentrations were predicted within a factor of two at two-thirds of the field sampling sites for elevated power plant plumes. The ratio of highest-second-highest 24-hour concentration to measured concentration ranged from about 0.2 to 2.7 at about 90 percent of the sampling sites.

In other validation studies for the point source model, the CRSTER model predicted peak short-term (1-, 3-, and 24-hour) concentration values within 30 to 70 percent at a plain site (EPRI 1983a:7-1–7-7). The CRSTER model predicted peak 1-hour concentrations within 2 percent and underpredicted peak 3-hour concentrations by about 30 percent at a moderately complex terrain site (EPRI 1985a:7-1). The ISCST model overpredicts 1-hour concentrations by about 60 percent with better predictions for longer time periods at an urban site (EPRI 1988a:5-2). Uses of gravitational settling/dry deposition and building downwash options were found to improve the model performance significantly over that of the model without such features (APCA 1986a:258-264; EPA 1981a:5-1,5-2; EPA 1982a:151,152).

F.1.2 SUPPORTING DATA

F.1.2.1 Overview

This section presents supporting information for each of the eight existing DOE sites considered under the No Action Alternative, and the various storage and disposition alternatives, as appropriate. Table F.1.2.1–1 presents the air quality standards applicable to each site. Subsequent sections present supporting information used in the air quality analysis at the Hanford Site (Hanford), Nevada Test Site (NTS), Idaho National Engineering Laboratory (INEL), Pantex Plant (Pantex), Oak Ridge Reservation (ORR), Savannah River Site (SRS), Rocky Flats Environmental Technology Site (RFETS), and Los Alamos National Laboratory (LANL).

F.1.2.2 Hanford Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at Hanford.

Climatology and Meteorology. Figure F.1.2.2–1 shows annual mean windspeeds and wind direction frequencies for July 1989 through June 1990 measured at the 10-m (32.8-ft) level of the Hanford Meteorology Station. The wind rose shows that the maximum wind direction frequency for 1989-1990 is from the west-northwest. The mean windspeed from the west-northwest is 4.3 m/s (9.6 miles per hour [mph]); the maximum mean windspeed is 5 m/s (11.2 mph) from the west-southwest. The historical wind data from the site indicate that the prevailing wind direction is from the west-northwest. The average annual windspeed is 3.4 m/s (7.6 mph) (HF PNL 1994b:83-84).

The average annual temperature is 11.8 degrees Celsius (°C) (53.3 degrees Fahrenheit [°F]); average monthly temperatures vary from a minimum of -1.5 °C (29.3 °F) in January to a maximum of 24.7 °C (76.5 °F) in July (HF PNL 1994b:83-84).

The average annual precipitation at Hanford is 16.0 centimeters (cm) (6.3 inches (in) (HF PNL 1994b:83-84).

Topographic features have a significant impact on the climate of Hanford. All air masses that reach the region undergo some modification resulting from their passage over the complex topography of the Pacific Northwest. The climate of the region is strongly influenced by the Pacific Ocean and the Cascade Range to the west and by the Rocky Mountains to the east and the north. The Rocky Mountains play a key role in protecting the region from the severe winter storms and extremely low temperatures associated with modified arctic air masses that move southward through Canada.

The Hanford Meteorological Station's climatological summary and the National Severe Storms Forecast Center's database list only 24 tornado occurrences within 161 kilometers (km) (100 mi) of Hanford from 1916 to 1994.

Table F.1.2.1–1. Ambient Air Quality Standards Applicable to Existing Department of Energy Sites

Pollutant	Averaging Time	Primary NAAQS[a] (μg/m³)	Secondary NAAQS[a] (μg/m³)	Washington (Hanford) (μg/m³)	Nevada (NTS) (μg/m³)	Idaho (INEL) (μg/m³)	Texas (Pantex) (μg/m³)	Tennessee (ORR) (μg/m³)	Georgia and South Carolina (SRS) (μg/m³)	Colorado (RFETS) (μg/m³)	New Mexico (LANL) (μg/m³)
Criteria Pollutants											
Carbon monoxide	8-hour	10,000	[b]	10,000	10,000	10,000	10,000	10,000	10,000	10,000	7,689[c]
	1-hour	40,000	[b]	40,000	40,000	40,000	40,000	40,000	40,000	40,000	11,578[c]
Lead	Calendar quarter	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	24-hour	[b]	[b]	0.5	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Nitrogen dioxide	Annual	100	100	100	100	100	100	100	100	100	73[c]
	24-hour	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	145[c]
Ozone	1-hour	235	235	235	235	235	235	235	235	235	235
Particulate matter less than or equal to 10 microns in diameter	Annual	50	50	50	50	50	50	50	50	50	50
	24-hour	150	150	150	150	150	150	150	150	150	150
Sulfur dioxide	Annual	80	[b]	52	80	80	80	80	80	80	40[c]
	24-hour	365	[b]	260	365	365	365	365	365	365	202[c]
	3-hour	[b]	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
	3-hour	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	700[d]	[b]
	1-hour	[b]	[b]	1,018	[b]	[b]	[b]	[b]	[b]	[b]	[b]
	1-hour	[b]	[b]	655[e]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
	30-minute	[b]	[b]	[b]	[b]	[b]	1,045	[b]	[b]	[b]	[b]

Table F.1.2.1–1. Ambient Air Quality Standards Applicable to Existing Department of Energy Sites—Continued

Pollutant	Averaging Time	Primary NAAQS[a] (μg/m³)	Secondary NAAQS[a] (μg/m³)	Washington (Hanford) (μg/m³)	Nevada (NTS) (μg/m³)	Idaho (INEL) (μg/m³)	Texas (Pantex) (μg/m³)	Tennessee (ORR) (μg/m³)	Georgia and South Carolina (SRS) (μg/m³)	Colorado (RFETS) (μg/m³)	New Mexico (LANL) (μg/m³)
State and County Mandated Pollutants											
Beryllium	24-hour	b	b	b	b	b	0.01	b	b	b	b
Gaseous fluoride	30-day	b	b	0.8	b	b	0.8	1.2	0.8	b	b
	7-day	b	b	1.7	b	b	1.6	1.6	1.6	b	b
	24-hour	b	b	2.9	b	b	2.9	2.9	2.9	b	b
	12-hour	b	b	3.7	b	b	3.7	3.7	3.7	b	b
	8-hour	b	b	b	b	b	b	250	b	b	b
Hydrogen sulfide	1-hour	b	b	b	112	b	b	b	b	142	11[c]
	30-minute	b	b	b	b	b	111	b	b	b	b
Sulfuric acid	24-hour	b	b	b	b	b	15	b	b	b	b
	1-hour	b	b	b	b	b	50	b	b	b	b
Total reduced sulfur		b	b	b	b	b	b	b	b	b	3
Total suspended particulates	Annual	b	b	60	b	60	b	b	75	75	60[c]
	30-day	b	b	b	b	b	b	b	b	b	90[c]
	7-day	b	b	b	b	b	b	b	b	b	110[c]
	24-hour	b	b	150	b	150	b	150	b	150	150[c]
	3-hour	b	b	b	b	b	200	b	b	b	b
	1-hour	b	b	b	b	b	400	b	b	b	b

[a] The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The ozone standard is attained when the expected number of days per year with maximum hourly average concentrations above the standard is ≤ 1. The 24-hour particulate matter standard is attained when the expected number of days with a 24-hour average concentration above the standard is ≤ 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The calendar quarter lead standard is not to be exceeded.

[b] There is no standard.

[c] State standard. The conversion from ppm to μg/m³ for the ambient air quality standard is calculated with the corrections for temperature (21 °C) and pressure (elevation) (7,400 ft mean sea level).

[d] State of Colorado also has an incremental standard for sulfur dioxide.

[e] The standard is not to be exceeded more than twice in any seven consecutive days.

Note: NAAQS=National Ambient Air Quality Standards; μg-microgram.

Source: 40 CFR 50; CO DPHE 1994a; ID DHW 1995a; ID DHW 1995b; ID DHW 1995c; NM EIB 1995a; NM EIB 1996a; NV DCNR 1995a; SC DHEC 1992b; TN DEC 1994a; TX NRCC 1992a; WA Ecology 1994a.

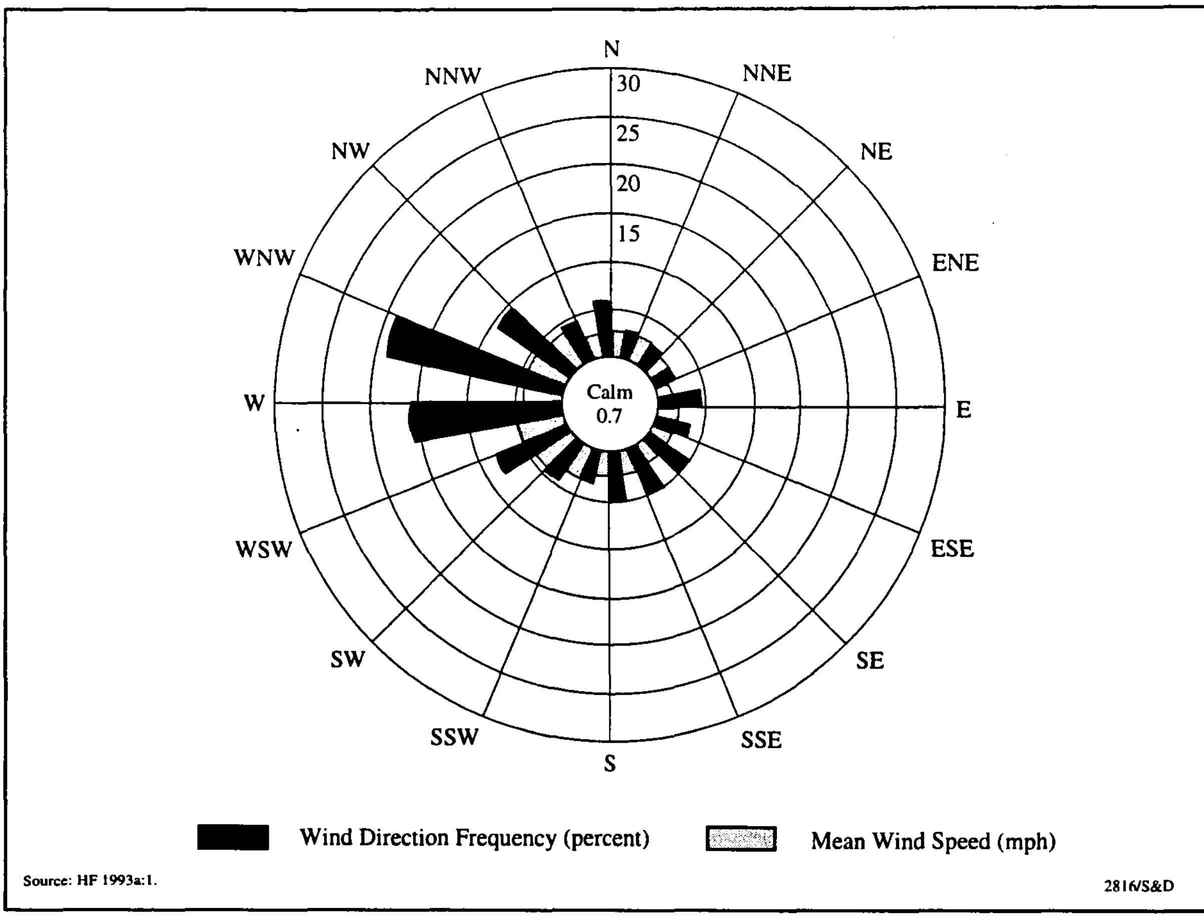


Figure F.1.2.2–1. Wind Distribution at Hanford Site, 1989-1990 (10-meter level).

Only one of these tornadoes was observed within the boundaries of Hanford (on its extreme western edge), and no damage resulted. The estimated probability of a tornado striking a point at Hanford is 9.6×10^{-6}/year (yr) (HF PNL 1994a:4.10). Because tornadoes are infrequent and generally small in the Pacific Northwest (and hurricanes do not reach this area), risks from severe winds are generally associated with thunderstorms or the passage of strong cold fronts. The greatest peak wind gust recorded at 15.2 m (50 ft) above ground level at the Hanford Meteorology Station was 36 m/s (80 mph). Observations indicate a return period of about 200 years for a peak gust in excess of 40 m/s (90 mph) at 15.2 m (50 ft) above ground level (HF PNL 1983a:V-2,V-13, XI-1).

Emission Rates. Table F.1.2.2–1 presents the emission rates for criteria and toxic/hazardous pollutants at Hanford. These emission rates were used as input into the ISCST2 model to estimate No Action pollutant concentrations.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the Hanford boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at Hanford meteorological monitoring station indicate that unstable conditions occur approximately 25 percent of the time, neutral conditions approximately 31 percent, and stable conditions approximately 44 percent, on an annual basis (HF 1993a:1).

Table F.1.2.2–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Hanford Site[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
Carbon monoxide	11,660
Nitrogen dioxide	46,660
Particulate matter less than or equal to 10 microns in diameter[b]	4,566
Sulfur dioxide	200
Total suspended particulates[b]	4,566
Volatile organic compounds	927.8
Toxic/Hazardous Pollutants	
Ammonia	2.26

[a] For stationary sources within Hanford Site projected for 2005.

[b] Total suspended particulates emissions are assessed as particulate matter less than or equal to 10 microns in diameter.

Note: yr=year.

Source: HF 1995a:1.

F.1.2.3 Nevada Test Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at NTS.

Climatology and Meteorology. Figure F.1.2.3–1 shows annual mean windspeeds and wind direction frequencies for 1991 measured at the 10-m (32.8-ft) level of the Desert Rock National Weather Service station. The wind rose shows that the maximum wind direction frequency for 1991 is from the northeast with a secondary maximum from the north-northeast. The mean windspeed from the northeast is 4.2 m/s (9.4 mph) and from the north-northeast it is 4.7 m/s (10.5 mph); the maximum mean windspeed is 6.3 m/s (14.1 mph) from the south-southwest.

Historical data indicate that predominating winds are southerly during summer and northerly during winter. The general downward slope in the terrain from north to south results in an intermediate scenario that is reflected in the characteristic diurnal wind reversal from southerly winds during the day to northerly winds at night. This north-to-south reversal is strongest in the summer and, on occasion, becomes intense enough to override the wind regime associated with large-scale pressure systems. Average annual windspeeds and direction vary with location. At higher elevations on Pahute Mesa, the average annual windspeed is 4.7 m/s (10.5 mph). The prevailing wind direction during winter months is north-northeasterly, and during summer months, winds are southerly. In Yucca Flat, the average annual windspeed is 3.1 m/s (7 mph). The prevailing wind direction during winter months is north-northwesterly and during summer months is south-southwesterly. At Mercury, Nevada, the average annual windspeed is 3.6 m/s (8 mph), with northwesterly prevailing winds during the winter months and southwesterly winds during the summer months (NT DOE 1993e:2-17,2-19).

Elevation influences temperatures on NTS. At an elevation of 2,000 m (6,560 ft) above mean sea level (MSL) on Pahute Mesa, the average daily maximum/minimum temperatures are 4.4/-2.2 °C (40/28 °F) in January and 26.7/16.7 °C (80/62 °F) in July. In Yucca Flat, 1,195 m (3,920 ft) above MSL, the average daily maximum/minimum temperatures are 10.6/-6.1 °C (51/21 °F) in January and 35.6/13.9 °C (96/57 °F) in July (NT DOE 1993e:2-17,2-19).

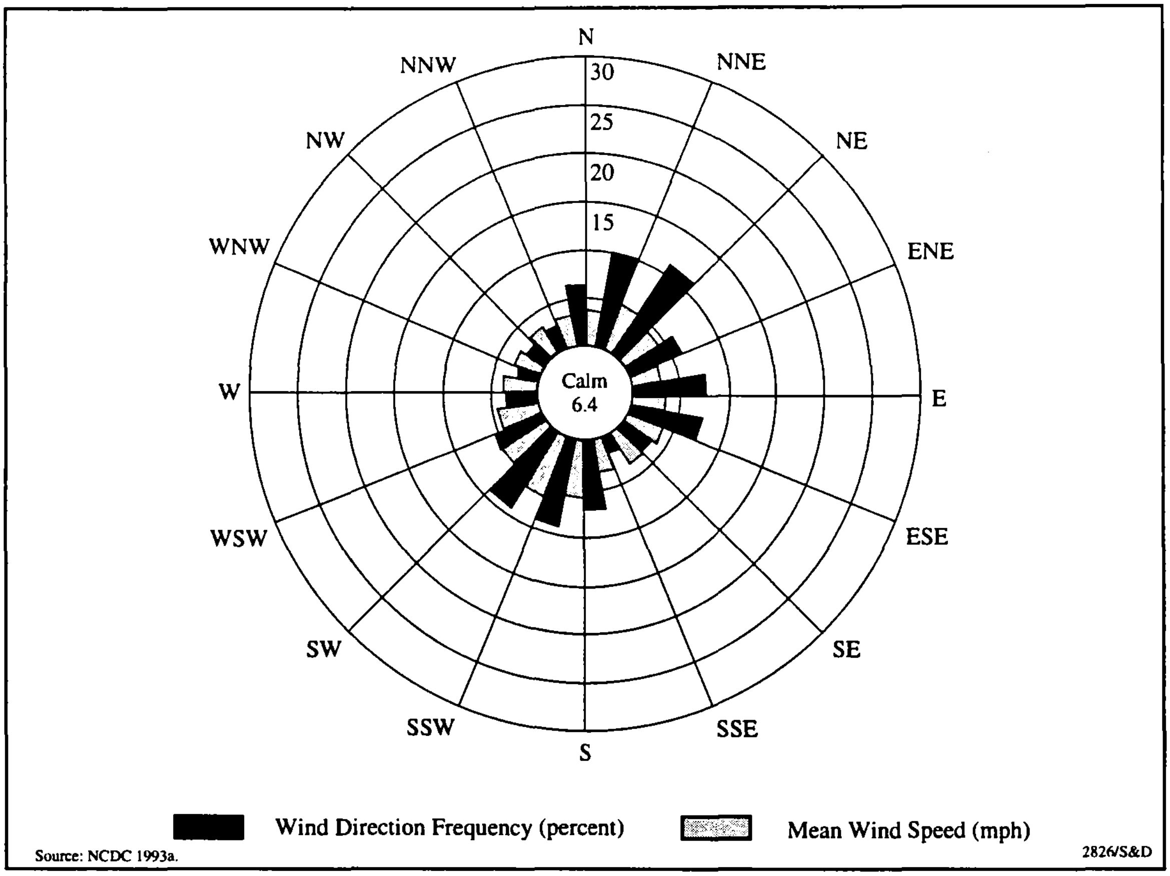


Figure F.1.2.3–1. Wind Distribution at Nevada Test Site, 1991 (10-meter level).

The average annual temperature at NTS is 19.5 °C (67.1 °F); temperatures vary from an average daily minimum of 0.9 °C (33.6 °F) in January to an average daily maximum of 41.1 °C (105.9 °F) in July. The average annual precipitation at NTS is 10.5 cm (4.13 in) (NOAA 1994d:3).

Annual precipitation in southern Nevada is very light and depends largely upon elevation. On NTS, the mesas receive an average annual precipitation of 23 cm (9 in), which includes winter snow accumulations. The lower elevations receive approximately 15 cm (6 in) of precipitation annually, with occasional snow accumulations lasting only a few days (NT DOE 1993e:2-17,2-19).

Precipitation usually falls in isolated showers with large variations in precipitation amounts within a shower area. Summer precipitation occurs mainly in July and August when intense heating of the ground below moist air masses triggers thunderstorm development. On rare occasions, a tropical storm will move northeastward from the coast of Mexico, bringing heavy precipitation during September and October.

Other than temperature extremes, severe weather in the region includes occasional thunderstorms, lightning, tornadoes, and sandstorms. Severe thunderstorms may produce high precipitation with durations of approximately 1 hour and may create a potential for flash flooding (NT DOE 1983a:26). Tornadoes have been observed in the region but are infrequent. The estimated probability of a tornado striking a point at NTS is 3.0×10^{-7}/yr (NRC 1986a:32).

Emission Rates. Table F.1.2.3–1 presents the emission rates for criteria and toxic/hazardous pollutants at NTS. These emission rates were used as input into the ISCST2 model to estimate pollutant concentrations.

Table F.1.2.3–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Nevada Test Site[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
Carbon monoxide	b
Nitrogen dioxide	b
Particulate matter less than or equal to 10 microns in diameter[c]	86,820
Sulfur dioxide	71,125
Total suspended particulates[c]	86,820
Toxic/Hazardous Pollutants (no toxic sources indicated)	

[a] Based on permitted sources (1990-1992).
[b] No pollutant sources indicated.
[c] It is assumed that PM_{10} emissions are TSP emissions.
Note: yr=year.
Source: NV DCNR 1992a.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the NTS boundary for No Action, criteria pollutant emissions were modeled from actual stack locations using operating permit data on stack height, stack diameter, exit velocity, and exit temperature (NV DCNR 1992a).

Atmospheric Dispersion Characteristics. Data collected at the NTS meteorological monitoring station for 1991 indicate that unstable conditions occur approximately 26 percent of the time, neutral conditions approximately 37 percent, and stable conditions approximately 37 percent, on an annual basis.

F.1.2.4 Idaho National Engineering Laboratory

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at INEL.

Climatology and Meteorology. Figure F.1.2.4–1 shows annual mean windspeeds and wind direction frequencies for 1992 measured at the 10-m (32.8-ft) level of the INEL meteorological tower. The wind rose shows that the maximum wind direction frequency is from the southwest with a secondary maximum from the north-northeast. The mean windspeed from the southwest is 5.2 m/s (11.6 mph) and from the north-northeast it is 2.8 m/s (6.3 mph); the maximum mean windspeed is 5.5 m/s (12.3 mph) from the west-southwest.

The historical wind data from the site indicate that prevailing wind directions are from the southwest to west-southwest with a secondary maximum from the north-northeast to northeast. The annual average windspeed is 3.4 m/s (7.5 mph) (IN DOE 1989b:28,30,55,77).

The average annual temperature at INEL is 5.6 °C (42.0 °F); average monthly temperatures vary from a minimum of -8.8 °C (16.1 °F) in January to a maximum of 20 °C (68 °F) in July. The average annual precipitation at INEL is 22.1 cm (8.71 in) (IN DOE 1989b:28,30,55,77).

The maximum instantaneous wind gust recorded at the Central Facilities Area Weather Station (6.1-m [20-ft] level) was 34.9 m/s (78 mph) from the west-southwest, and the maximum hourly average windspeed, also from the west-southwest, was 22.8 m/s (51 mph) (IN DOE 1989b:28,30,55,77).

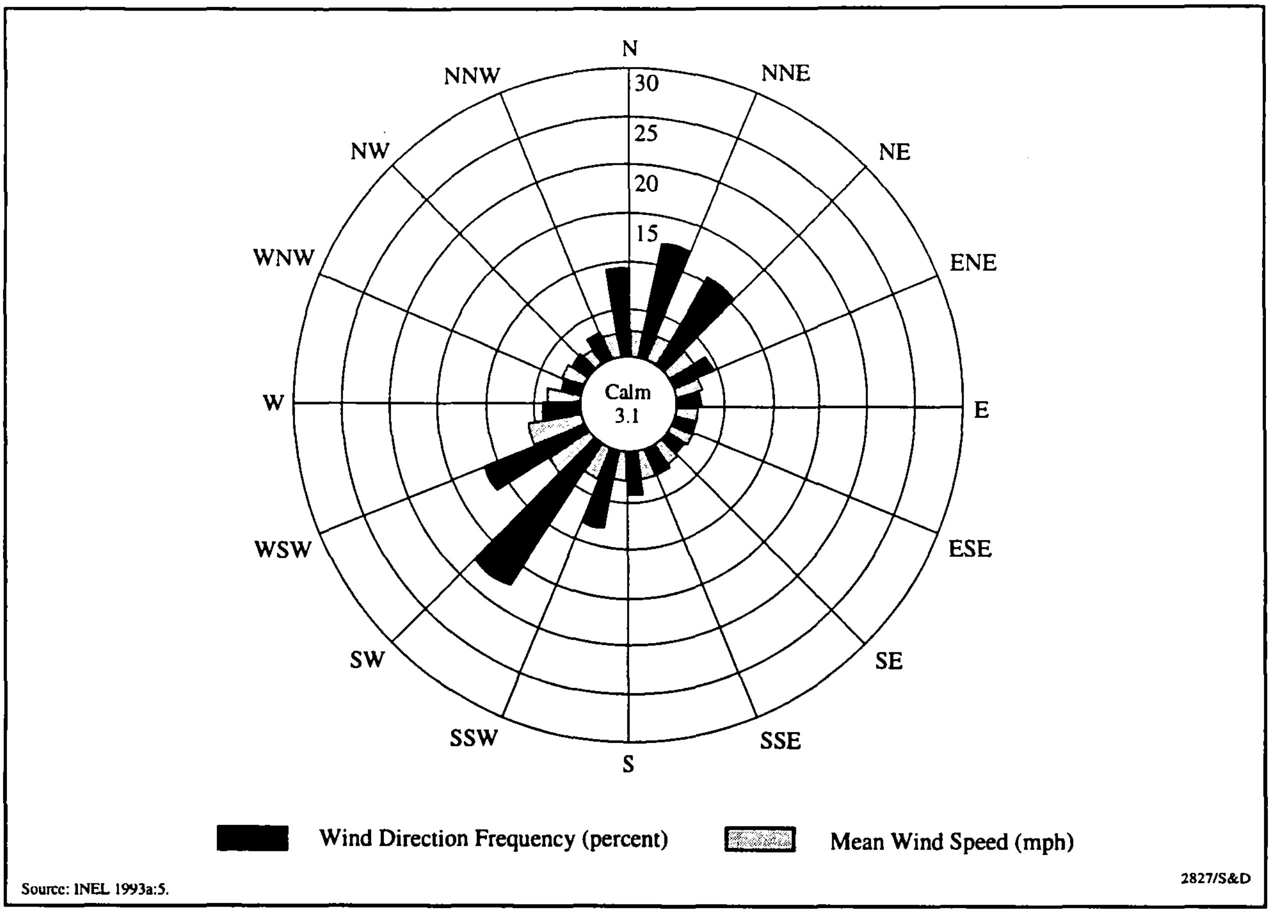


Figure F.1.2.4–1. Wind Distribution at Idaho National Engineering Laboratory, 1992 (10-meter level).

Other than thunderstorms, severe weather is uncommon. The months of June, July, and August each average two to three thunderstorm days. Hail storms occur occasionally, with the hail usually smaller than 0.64-cm (0.25-in) diameter. Tornadoes are very infrequent in the area. Between 1950 and 1989, a total of five funnel clouds and no tornadoes were sighted within the boundary of INEL (IN DOE 1989b:100-102). The estimated probability of a tornado striking a point at INEL is 6.0×10^{-7} per year (NRC 1986a:32).

Emission Rates. Table F.1.2.4–1 presents the emission rates for criteria and toxic/hazardous pollutants at INEL. These emission rates were used as input into the ISCST2 model to estimate pollutant concentrations. INEL exceeds the applicable 227,000 kilograms (kg)/yr (250 short tons (tons)/yr) emissions criterion for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter less than or equal to 10 microns in diameter (PM_{10}), and is therefore classified as an existing major source for these pollutants. The classification of INEL as a major source may require further prevention of significant deterioration review than sites not classified as a major source.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the INEL site boundary, criteria pollutant emissions were modeled from actual stack locations using operating permit data on stack height, stack diameter, exit velocity, and exit temperature (INEL 1995a:1). Toxic/hazardous pollutant emissions were modeled from a centrally located stack at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Table F.1.2.4–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Idaho National Engineering Laboratory[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	2,200,000
Lead	68
NO_2	3,000,000
PM_{10}[b]	900,000
SO_2	1,700,000
Total suspended particulates[b]	900,000
[Text deleted]	
Toxic/Hazardous Pollutants[c]	
1,3-Butadiene	390
[Text deleted]	
Acetaldehyde	180
Ammonia	6,500
Arsenic	24
Benzene	530
Carbon tetrachloride	28
[Text deleted.]	
Chromium-hexavalent	26
Cyclopentane	350
[Text deleted.]	
Formaldehyde	3,300
Hydrazine	8.3
[Text deleted]	
Hydrogen chloride	1,500
[Text deleted]	
Mercury	200
Methylene chloride	1,100
Naphthalene	16
Nickel	1,000
Nitric acid	97,000
Perchloroethylene	980
Phosphorous	210
Potassium hydroxide	2,100
Propionaldehyde	110
Styrene	4.7
Toluene	580
Trichloroethylene	4.5
Trimethylbenzene	87
Trivalent chromium	38

[a] Emissions from historical data (1990) are assumed for No Action (2005).
[b] It is assumed that PM_{10} emissions are TSP emissions.
[c] Hazardous/toxic air pollutants that are listed in State of Idaho regulations and are emitted in quantities that exceed screening criteria.
Source: DOE 1995v; INEL 1995a:1.

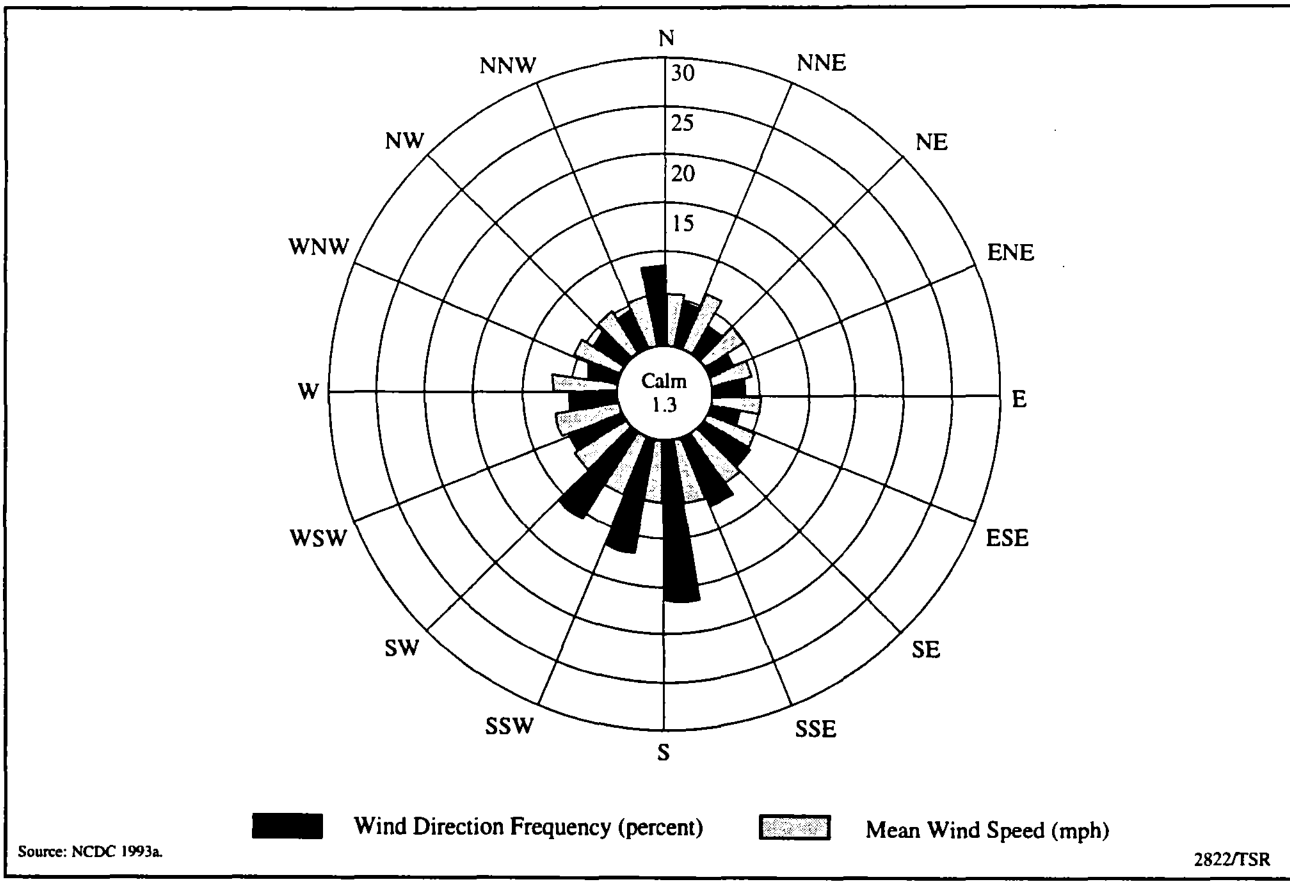


Figure F.1.2.5–1. Wind Distribution at Amarillo, 1991 (10-meter level).

Atmospheric Dispersion Characteristics. Data collected at INEL meteorological monitoring stations for 1992 indicate that unstable conditions occur approximately 22 percent of the time, neutral conditions approximately 26 percent, and stable conditions approximately 52 percent, on an annual basis.

F.1.2.5 Pantex Plant

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at Pantex.

Climatology and Meteorology. Figure F.1.2.5–1 shows annual mean windspeeds and wind direction frequencies for 1991 measured at the 10-m (32.8-ft) level of the Amarillo National Weather Service station. The wind rose shows that the maximum wind direction frequency is from the south with a secondary maximum from the south-southwest. The mean windspeed from the south is 6.3 m/s (14.1 mph) and from the south-southwest it is 6.3 m/s (14.1 mph); the maximum mean windspeed is 6.6 m/s (14.8 mph) from the west.

Historical data indicate that prevailing wind directions are from the south to southwest. The annual average windspeed is 6.0 m/s (13.5 mph) (NOAA 1994c:3).

The average annual temperature at Pantex is 13.8 °C (56.9 °F); temperatures vary from an average daily minimum of -5.7 °C (21.8 °F) in January to an average daily maximum of 32.8 °C (91.1 °F) in July (NOAA 1994c:3).

The average annual precipitation at Pantex is 49.7 cm (19.6 in). Most of the annual precipitation falls between April and October and usually occurs from thunderstorm activity and the intrusion of warm, moist tropical air from the Gulf of Mexico. Snowfall has occurred in the area from October to April and averages nearly 42.9 cm (16.9 in) annually. The maximum 24-hour rainfall with a 100-year recurrence interval is approximately 16.5 cm (6.5 in). On average, the area can expect thunderstorms about 50 days/yr, hail 4 days/yr, and freezing rain 8 days/yr. During the 30-year period between 1954 and 1983, a total of 108 tornadoes were reported within a 1-degree latitude and longitude square area that includes Pantex. On average, fewer than four tornadoes occur in an area of 10,096 square kilometers (km^2) (3,898 square miles [mi^2]) surrounding Pantex per year. The estimated probability of a tornado striking a point at Pantex is 2.3×10^{-4}/yr (NRC 1986a:32).

Emission Rates. Table F.1.2.5–1 presents the emission rates for criteria and toxic/hazardous pollutants at Pantex.

Table F.1.2.5–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Pantex Plant

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	22,493
NO_2	54,056
Lead	185
PM_{10}	8,439
SO_2	0.1
Total suspended particulates	[a]
Hydrogen fluoride	1,176
Toxic/Hazardous Pollutants	
1,1,1-Chloroethane	22.74
[Text deleted]	
1,1,2-Trichloroethane	3.78
2-Nitropropane	1.71
[Text deleted]	
Alcohols	1,184
[Text deleted]	
Benzene	91.38
Carbon disulfide	27.05
Carbon tetrachloride	15.59
Chlorobenzene	1.79
Chromium	2.14
Cresol	0.05
Cresylic acid	0.05
[Text deleted]	
Dibenzofuran	0.07
[Text deleted]	
Ester glycol ethers	0.86
Ethyl benzene	1.51
Ethylene dichloride	1.33
Formaldehyde	57.89
Hydrogen chloride	1,106.11

Table F.1.2.5–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Pantex Plant—Continued

Pollutant	Emission Rate (kg/yr)
Toxic/Hazardous Pollutants (continued)	
[Text deleted]	
Ketones	0.28
Mercury	0
Methanol	1,095.57
Methyl ethyl ketone	7,067.62
Methyl isobutyl ketone	0.62
Methylene chloride	182.07
Naphthalene	0.41
Nickel	0.16
Nitrobenzene	0.05
Phenol	2.23
[Text deleted]	
Tetrachloroethylene	6.44
Toluene	465.29
Trichloroethene	1.56
Trichloroethylene	19.50
Triethylamine	0
Xylene	222.15

[Text deleted.]

[a] Not available.
Source: PX DOE 1996b.

Modeling Assumptions. Baseline and No Action concentrations were based on actual source locations and stack parameters. In order to estimate maximum pollutant concentrations for alternatives at or beyond the Pantex boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack in the Pantex complex at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1.0 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at the Amarillo meteorological monitoring station for 1991 indicate that unstable conditions occur approximately 14 percent of the time, neutral conditions approximately 64 percent, and stable conditions approximately 22 percent, on an annual basis.

F.1.2.6 Oak Ridge Reservation

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at ORR.

Meteorology and Climatology. The wind direction above the ridge tops and within the valley at ORR tends to follow the orientation of the valley. On an annual basis, the prevailing winds at the National Weather Service (NWS) station in the city of Oak Ridge are either up-valley, from west to southwest, or down-valley, from east to northeast. Figure F.1.2.6–1 shows mean windspeeds and direction frequencies for 1990 measured at the 30-m (100-ft) level of the ORR meteorology tower. The wind rose shows that the maximum wind direction frequency is from the east-northeast with a secondary maximum from the northeast. The mean windspeed from the east-northeast is 1.7 m/s (3.8 mph) and from the northeast it is 2.3 m/s (5.1 mph); the maximum mean windspeed is 3.3 m/s (7.4 mph) from the southwest.

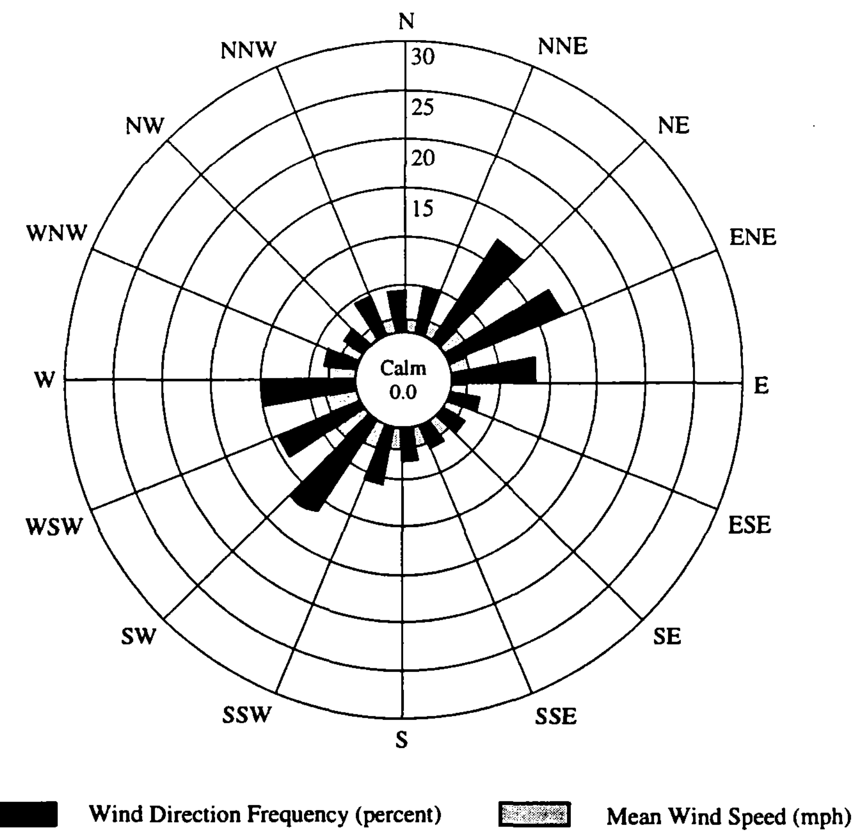


Figure F.1.2.6–1. Wind Distribution at Oak Ridge Reservation, 1990 (30-meter level).

The historical data indicate that prevailing wind directions are from the southwest and northeast quadrants. Mean annual windspeeds measured in the region are relatively low, averaging 2.0 m/s (4.4 mph) at the Oak Ridge NWS station at the 14-m (46-ft) level and 2.1 m/s (4.7 mph) at the 10-m (32.8-ft) level at the ORR Bethel Valley monitoring station (ORNL 1982a:2-95 – 2-113).

The average annual temperature at ORR is 13.7 °C (56.6 °F); temperatures vary from an average daily minimum of -3.8 °C (25.1 °F) in January to an average daily maximum of 30.4 °C (86.7 °F) in July. Relative humidity readings taken four times per day range from 51 percent in April to 92 percent in August and September (NOAA 1994c:3).

The average annual precipitation measured at ORR in Bethel Valley is 130.8 cm (51.5 in), while the average annual precipitation for the Oak Ridge NWS station is 136.6 cm (53.8 in). The maximum monthly precipitation recorded at the Oak Ridge NWS station was 48.95 cm (19.27 in) in July 1967, while the maximum rainfall in a 24-hour period was 19.0 cm (7.48 in) in August 1960. The average annual snowfall as measured at the Oak Ridge NWS station is 24.9 cm (9.8 in).

Damaging winds are uncommon in the region. Peak gusts recorded in the area range from 26.8 m/s (60 mph) to 30.8 m/s (69 mph) for the months of January through July; from 21.9 to 26.8 m/s (49 to 60 mph) for August, September, and December; and 16.1 to 20.1 m/s (36 to 45 mph) in October and November (ORNL 1982a:2-72). The fastest mile windspeed (the 1 mi [1.6 km] passage of wind with the highest speed for the day) recorded at the Oak Ridge NWS station for the period of 1958 through 1979 was 26.4 m/s (59 mph) in January 1959 (NOAA 1994c:3).

The extreme mile windspeed at a height of 9.1 m (30 ft) that is predicted to occur near ORR once in 100 years is approximately 39.8 m/s (89 mph). The approximate values for occurrence intervals of 10, 25, and 50 years are 28.6, 33.1, and 34.0 m/s (64, 74, and 76 mph), respectively (ORNL 1981a:3.3-7).

Between 1916 and 1972, 25 tornadoes were reported in the counties of Tennessee having borders within about 64 km (40 mi) of ORR (ORNL 1981a:3.3-7). The probability of a tornado striking a particular point in the vicinity of ORR is estimated to be 3.6×10^{-4} per year (ORNL 1982a:2-125).

On February 21, 1993, a tornado passed through the northeastern edge of ORR and caused considerable damage to a large number of structures in the nearby Union Valley Industrial Park. Damage to ORR from this tornado was relatively light. The windspeeds associated with this tornado ranged from 17.9 m/s (40 mph) to nearly 58 m/s (130 mph) (OR DOE 1993c:iii).

Emission Rates. Table F.1.2.6–1 presents the emission rates for criteria and toxic/hazardous pollutants at ORR. The emission rates were used as input into the ISCST2 model to estimate pollutant concentrations. ORR exceeds the applicable 227,000 kg/yr (250 tons/yr) emissions criterion for NO_2 and SO_2 and is therefore classified as an existing major source for these pollutants. The classification of ORR as a major source may require further prevention of significant deterioration review than sites not classified as a major source.

Table F.1.2.6–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Oak Ridge Reservation[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	95,000
NO_2	870,000
PM_{10}	8,300
SO_2	972,000
Total suspended particulates	1,125,000
Toxic/Hazardous Pollutants	
1,1,1-Trichloroethane	220
Acetic acid	1
Chlorine	1,750
Hydrogen chloride	6,420
Hydrogen fluoride	70
Hydrogen sulfide	[b]
Methyl alcohol	26,400
Nitric acid	9,500
Sulfuric acid	2,500

[a] Emissions from historical data (1992) are assumed for No Action (2005).
[b] No sources of this pollutant have been identified.
Source: OR LMES 1996i.

Modeling Assumptions. In order to estimate maximum pollutant alternatives for concentrations at or beyond the ORR site boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack in the Y–12 complex at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), exit velocity of 0.03 m/s (0.1 ft/s), and exit temperature equal to ambient temperature.

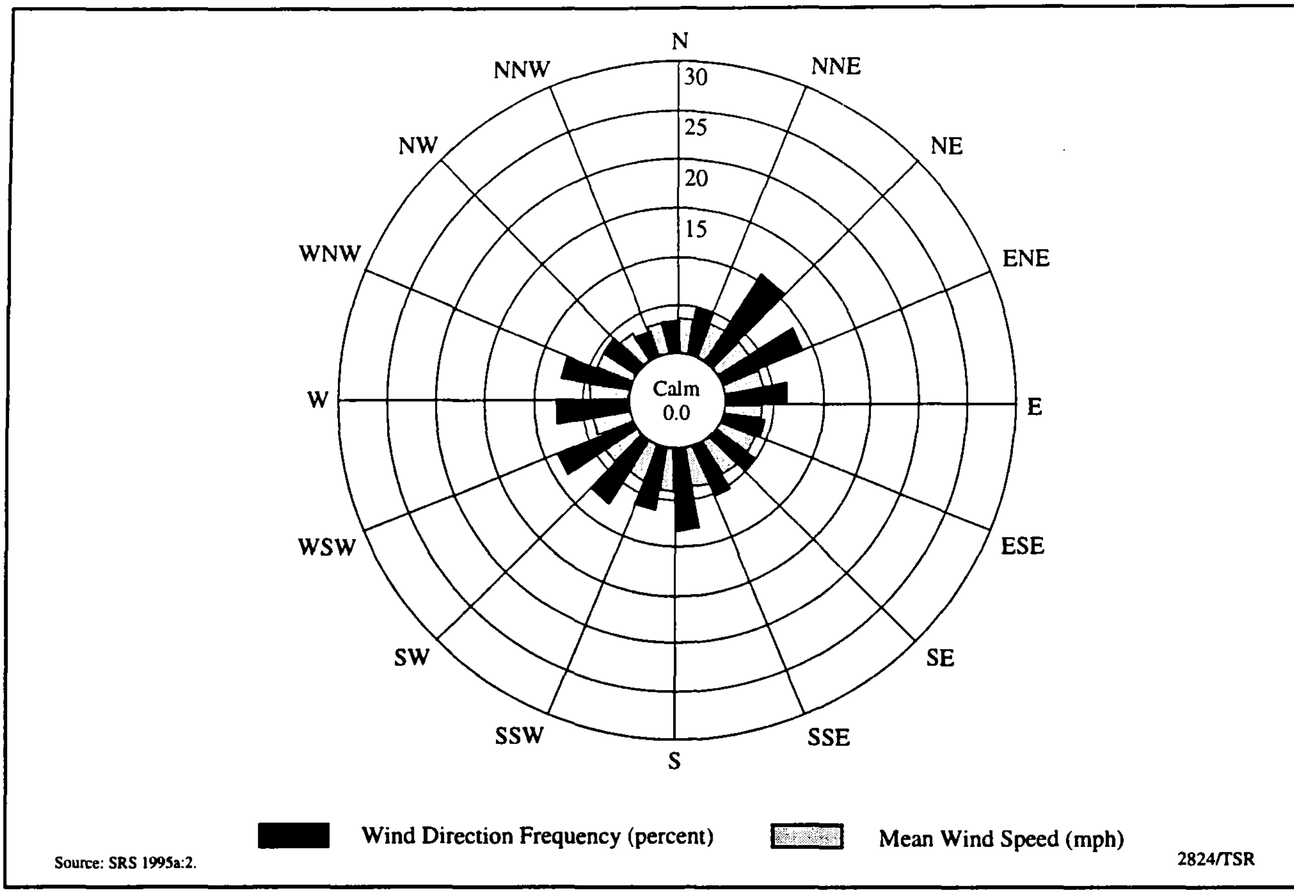


Figure F.1.2.7–1. Wind Distribution at Savannah River Site, 1991 (61-meter level).

Atmospheric Dispersion Characteristics. Data collected at the ORR meteorological monitoring station (Y–12 Plant east tower) for calendar year 1990 indicate that unstable conditions occur approximately 23 percent of the time, neutral conditions approximately 31 percent, and stable conditions approximately 46 percent, on an annual basis.

F.1.2.7 Savannah River Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at SRS.

Climatology and Meteorology. Figure F.1.2.7–1 shows annual mean windspeeds and wind direction frequencies for 1991 measured at the 61-m (200-ft) level of the SRS H-Area Weather Station. The wind rose shows that the maximum wind direction frequency is from the northeast with a secondary maximum from the east-northeast. The mean windspeed from the northeast is 3.8 m/s (8.5 mph) and from the east-northeast it is 3.8 m/s (8.5 mph); the maximum mean windspeed is 4.1 m/s (9.2 mph) from the west-northwest.

The historical wind data from the site indicate that there is no predominant wind direction at SRS. The highest directional frequency is from the northeast. The average annual windspeed is 3.75 m/s (8.4 mph).

The average annual temperature at SRS is 17.3 °C (63.2 °F); temperatures vary from an average daily minimum of 0 °C (32 °F) in January to an average daily maximum of 33.2 °C (91.7 °F) in July. Relative humidity readings taken four times per day range from 45 percent in April to 92 percent in August and September.

The average annual precipitation at SRS is 113.4 cm (44.7 in). Precipitation is distributed fairly evenly throughout the year, with the highest precipitation in summer, 32.7 cm (12.87 in), and the lowest in autumn, 21.2 cm (8.34 in). Although snow can fall from November through April, the average annual snowfall is only 2.8 cm (1.1 in); large snowfalls are rare.

Winter storms in the SRS area occasionally bring strong, gusty surface winds with speeds as high as 22.8 m/s (51 mph). Thunderstorms can generate winds with speeds as high as 21.5 m/s (48.1 mph) and even stronger gusts. The fastest 1-minute windspeed recorded at Augusta between 1952 and 1993 was 27.7 m/s (62 mph) (NOAA 1994c:3).

The average number of thunderstorm days per year at SRS is 56. From 1954 to 1983, 37 tornadoes were reported in a 1-degree square of latitude and longitude that includes SRS. This frequency of occurrence amounts to an average of about one tornado per year. The estimated probability of a tornado striking a point at SRS is 7.1×10^{-5} per year (NRC 1986a:32). Since operations began at SRS in 1953, nine tornadoes have been confirmed on or near SRS. Nothing more than light damage was reported in any of these storms, with the exception of a tornado near SRS. Nothing more than light damage was reported in any of these storms, with the exception of a tornado in October 1989. That tornado caused considerable damage to timber resources in an undeveloped wooded area of SRS (WSRC 1990b:1).

From 1899 to 1980, 13 hurricanes occurred in Georgia and South Carolina, for an average frequency of about 1 hurricane every 6 years. Three hurricanes were classified as major. Because SRS is about 160 km (99.4 mi) inland, the winds associated with hurricanes have usually diminished below hurricane force (below a sustained speed of 33.5 m/s [75.0 mph]) before reaching the site (DOE 1992e:4-115).

Emissions Rates. Table F.1.2.7–1 presents the emission rates for criteria and toxic/hazardous pollutants at SRS. SRS exceeds the applicable 227,000 kg/yr (250 tons/yr) emissions criterion for CO, NO_2, SO_2 and PM_{10} and is therefore classified as an existing major source for these pollutants. The classification of SRS as a major source may require further prevention of significant deterioration review than sites not classified as a major source.

Modeling Assumptions. Emission rates for baseline and No Action for criteria and toxic/hazardous pollutants were based upon the latest sitewide emissions inventory data for the year 1990. Baseline and No Action concentrations were based on actual source locations and stack parameters. In order to estimate maximum criteria and toxic/hazardous pollutant concentrations at or beyond the SRS site boundary for the various storage and disposition alternatives, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), exit velocity of 0.03 m/s (0.1 ft/s), and exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at SRS meteorological monitoring station for 1991 indicate that unstable conditions occur approximately 38 percent of the time, neutral conditions approximately 43 percent, and stable conditions approximately 19 percent, on an annual basis (SRS 1995a:2).

F.1.2.8 Rocky Flats Environmental Technology Site

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeeds and direction frequencies at RFETS.

Climatology and Meteorology. Figure F.1.2.8–1 shows annual mean windspeeds and wind direction frequencies for 1990 measured at the 61.0-m (200-ft) level of the 61-m (200-ft) tower in the west buffer zone. The wind rose shows that the maximum wind direction frequency is west-northwest with a secondary maximum from the west. The mean windspeed from the west-northwest is 6.3 m/s (14.1 mph); the maximum mean windspeed is 5.7 m/s (12.8 mph) from the west.

Table F.1.2.7–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Savannah River Site[a]

Pollutant	Emission Rate (kg/yr)	
Criteria Pollutants		
CO	404,449	
NO_2	4,278,380	
PM_{10}	1,963,180	
SO	9,454,199	
Total suspended particulates	4,430,890	
Hydrogen fluoride	16,690	
Toxic/Hazardous Pollutants	**Point & Volume Source (kg/yr)**	**Area Source**[b] **($kg/yr/m^2$)**
3,3-Dichlorobenzidine	211.0	c
Acrolein	c	1.94×10^{-3}
Benzene	129,772.3	0.21
Bis (chloromethyl) ether	211.0	c
Cadmium oxide	243.0	c
Chlorine	21,146.7	10.11
Chloroform	1,035,006	13.6
Cobalt	5,970.2	4.58×10^{-4}
Formic acid	46,949.5	c
Manganese	27,882.1	2.61
Mercury	917.5	1.15×10^{-3}
Nickel	23,022.5	6.02
Nitric acid	1,150,525.8	c
Parathion	d	d
Phosphoric acid	14,859.8	c

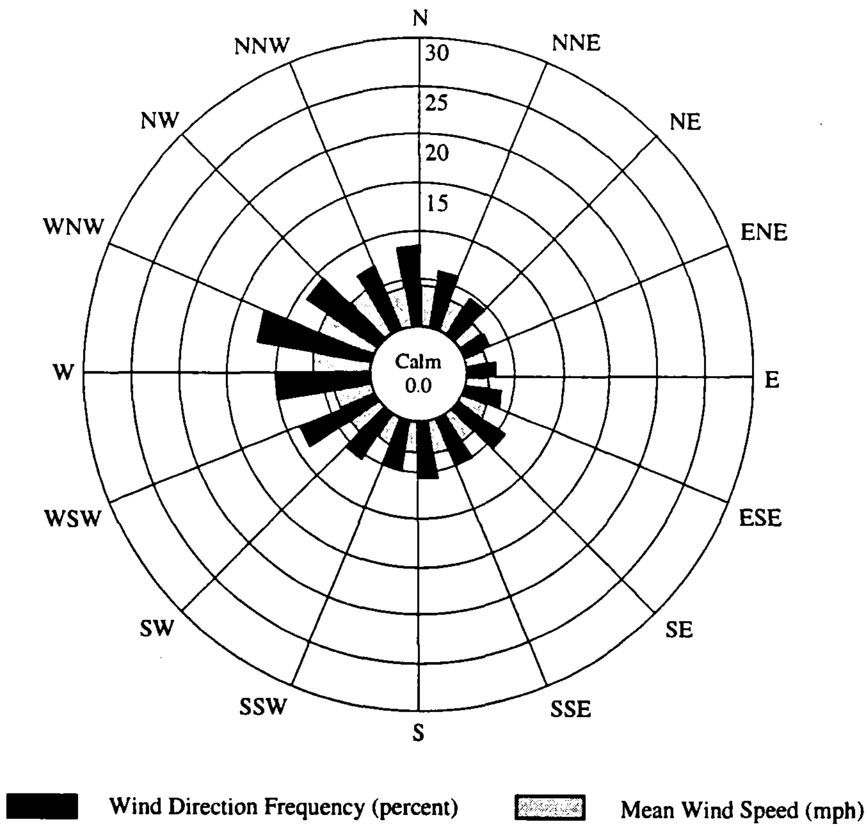
[a] Emissions from historical data (1990) are assumed for No Action (2005).
[b] Some toxic/hazardous pollutant sources were modeled as area sources, the remainder were modeled as point or volume sources.
[c] No sources of this pollutant have been identified.
[d] Data not available.
Source: SRS 1995a:10; WSRC 1993c.

The historical data indicate that the predominant wind direction is from the west-northwest. The average annual windspeed is 3.8 m/s (8.6 mph) (NOAA 1994a:3).

The average annual temperature at RFETS is 10.2 °C (50.3 °F); temperatures vary from an average daily minimum of -8.8 °C (16.1 °F) in January to an average daily maximum of 31.2 °C (88.2 °F) in July. The average annual precipitation at RFETS is 39.1 cm (15.4 in) (NOAA 1994a:3).

Winter storms in the RFETS area can generate winds with speeds as high as 21.5 m/s (48 mph) and even stronger gusts. The fastest 1-minute windspeed recorded in Denver, Colorado, was 20.6 m/s (46 mph) (NOAA 1994a:3).

The average number of thunderstorm days per year at RFETS is 42. From 1954 to 1983, 13 tornadoes were reported for a 1-degree square of latitude and longitude that includes RFETS. This frequency of occurrence amounts to an average of less than one tornado per year. The estimated probability of a tornado striking a point at RFETS is 2.0×10^{-5} per year (NRC 1986a:32).



Source: RFP 1993a:2.

2825/S&D

Figure F.1.2.8–1. ***Wind Distribution at Rocky Flats Environmental Technology Site, 1990 (61-meter level).***

Emission Rates. Table F.1.2.8–1 presents the emission rates for criteria and toxic/hazardous pollutants at RFETS. These emission rates were used as input into the ISCST2 model to estimate pollutant concentrations.

Modeling Assumptions. In order to estimate maximum pollutant concentrations at or beyond the RFETS site boundary, criteria pollutant emissions and toxic/hazardous pollutant emissions were modeled from a centrally located stack in RFETS at a height of 10 m (32.8 ft), with a stack diameter of 0.3 m (1 ft), an exit velocity of 0.03 m/s (0.1 ft/s), and an exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at RFETS meteorological monitoring station for 1990 indicate that unstable conditions occur approximately 59 percent of the time, neutral conditions approximately 26 percent, and stable conditions approximately 15 percent, on an annual basis.

F.1.2.9 Los Alamos National Laboratory

This section provides information on climatology and meteorology, modeling assumptions, atmospheric dispersion characteristics, and annual mean windspeed and direction frequencies at LANL.

Climatology and Meteorology. Figure F.1.2.9–1 shows annual mean windspeed and wind direction frequencies for 1991 measured at the 11.5-m (37-ft) level of the Technical Area (TA)-6 meteorological tower. The wind

Table F.1.2.8–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Rocky Flats Environmental Technology Site[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutants	
CO	39,200
NO_2	183,000
PM_{10}	10,400
SO_2	13,100
State Mandated Pollutants	
Hydrogen sulfide	0.467
Total suspended particulates	12,600
Toxic/Hazardous Pollutants[b]	
1,1,2-Trichloro-1,2,2-trifluoroethane	109
Carbon tetrachloride	53.5
Methylene chloride	53.3
Trichloroethane	136

[a] Emissions from historical data (permits 1991-1994) are assumed for No Action (2005).
[b] Only those emitted at rates greater than 45 kg/yr are listed.
Source: RFETS 1995a:1.

rose shows that the maximum wind direction frequency is from the west-northwest with a secondary maximum from the west. The mean windspeed from the west-northwest is 3.2 m/s (7.2 mph), which is also the maximum mean windspeed. The mean windspeed is 3 m/s (6.7 mph) from the west.

The historical wind data from the site indicate that the prevailing wind directions are from the south through northwest. The average annual windspeed measured is 2.8 m/s (6.3 mph) (LANL 1995s:II-11).

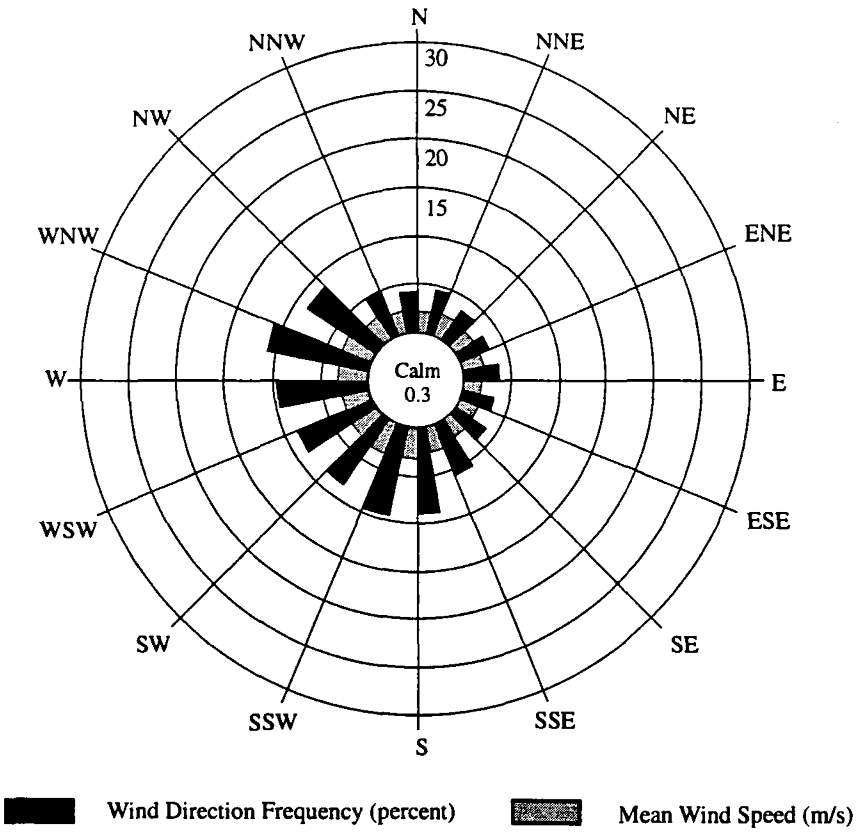
The average annual temperature at LANL is 8.8 °C (47.8 °F). In July, the average daily high temperature is 27.2 °C (81 °F), and the average nighttime low temperature is 12.8 °C (55 °F). The highest recorded temperature is 35 °C (95 °F). The average daily January high is 4.4 °C (40 °F), and the average nighttime low is -8.3 °C (17 °F). The lowest recorded temperature is -27.8 °C (-18 °F). Monthly average values of the dew point temperature range from -9.4 °C (15.0 °F) in January to 8.9 °C (48 °F) in August, when moist subtropical air invades the region. Fog is rare in Los Alamos, occurring on fewer than 5 days per year (LANL 1995s:II-8,II-11).

The average annual precipitation at LANL is 47.6 cm (18.7 in). Most of the annual precipitation falls during the months of July and August and usually occurs from convective storms. Snowfall averages nearly 150 cm (59 in). The maximum 24-hour rainfall is approximately 8.8 cm (3.5 in) (LANL 1994a:II-11).

The average number of thunderstorm days per year is 58, with most occurring during the summer. The estimated probability of a tornado striking a point at LANL is $2x10^{-5}$ per year (NRC 1986a:32). Historically, no tornadoes have been reported to have touched down in Los Alamos County (LANL 1993b:II-9).

Emission Rates. Table F.1.2.9–1 presents the emission rates for criteria and toxic/hazardous pollutants at LANL. These emission rates were used as input into the ISCST2 model, to estimate pollutant concentrations.

Modeling Assumptions. Additional model input used to estimate maximum pollutant concentrations at or beyond the LANL site boundary include the following: criteria pollutant emissions were modeled from actual



Source: LANL 1992a:6.

2854/SSM

Figure F.1.2.9–1. Wind Distribution at Los Alamos National Laboratory, 1991 (11.5-meter level).

stack locations using actual stack heights, stack diameter, exit velocity, and exit temperature, taken from operating permits; toxic/hazardous pollutant emissions were modeled from a centrally located stack in the LANL facility at a height of 10 m (32.8 ft), stack diameter of 0.3 m (1 ft), exit velocity of 0.03 m/s (0.1 ft/s), and exit temperature equal to ambient temperature.

Atmospheric Dispersion Characteristics. Data collected at the TA-6 meteorological tower for 1991 indicate that unstable conditions occur approximately 45 percent of the time, neutral conditions approximately 21 percent of the time, and stable conditions approximately 34 percent of the time, on an annual basis.

Table F.1.2.9–1. Emission Rates of Criteria and Toxic/Hazardous Pollutants at Los Alamos National Laboratory[a]

Pollutant	Emission Rate (kg/yr)
Criteria Pollutant	
CO	21,583
Lead	26
NO_2	55,314
PM_{10}	2,983
SO_2	704.6
Total suspended particulates[b]	2,983
Hazardous and Other Toxic Compounds	
1, 1, 2-Trichloroethane	927
2-Butoxyethanol	123
Acetic acid	537
Ammonia	799
Chloroform	533
Ethyl acetate	89
Ethylene glycol	72
Formaldehyde	49
Heptane (n-heptane)	1,849
Hexane (n-hexane)	77
Hydrogen chloride	638
Hydrogen fluoride (as F)	242
Isopropyl alcohol	539
Kerosene	260
Methyl alcohol	589
Methyl ethyl ketone	1,864
Methylene chloride	1,104
Nickel	55
Nitric acid	661
Nitrogen oxide	428
Propane sultone	205
Stoddard solvent	264
Toluene	2,483
Trichloroethylene	210
Tungsten (as W) (insoluble)	109
VM&P naptha	613
Xylene (o-, m-, p-isomers)	1,762

[a] Emissions from historical data (1990) are assumed for No Action (2005).

[b] It is assumed that PM_{10} emissions are total suspended particulates emissions.

Source: LANL 1994a.

F.1.3 AIR POLLUTANT EMISSIONS

Potential ambient air quality impacts of the emissions due to operation of the various storage and disposition facilities at each site were analyzed using ISCST2 as described in Section F.1.1. The source of the facility emissions is assumed to be that which is described under the Modeling Assumptions subsection in each of the preceding descriptions of the sites. The model input data include the emission inventories for each of the facilities as presented in Tables F.1.3–1 through F.1.3–14.

Table F.1.3–1. Emission Rates of Pollutants for Upgrade of Existing Facilities

		INEL			Pantex			SRS[a]	
Pollutant	Hanford[b] (kg/yr)	Without RFETS or LANL Material (kg/yr)	With RFETS and LANL Material (kg/yr)	With RFETS Pits (kg/yr)	Without RFETS or LANL Material (kg/yr)	With RFETS and LANL Material (kg/yr)	ORR (kg/yr)	With RFETS Non-pit Material (kg/yr)	With RFETS and LANL Material (kg/yr)
Criteria Pollutants									
CO	51.7	900	920	0	0	3,700	c	91	122
NO_2[d]	200	3,000	3,000	0	0	4,600	c	2,951	4,037
PM_{10}[e]	4.54	1,000	1,100	0	0	1,200	c	227	308
SO_2	3.36	4,900	5,200	0	0	85	c	8,626	11,884
Total suspended particulates[e]	4.54	1,000	1,100	0	0	1,200	c	227	308
Volatile organic compounds	50.8	84	86	0	0	550	c	23	32
Toxic/Hazardous Pollutants				0	0				
Ammonia	0	0	0	0	0	0	0	0	0
Chlorine	0	<1	<1	0	0	5	c	0	0
Hydrazine	0	<1	<1	0	0	<1	c	0	0
Hydrogen chloride	0	1	1	0	0	0	11.3	0	0
Hydrogen fluoride	0	1	1	0	0	0	11.3	0	0
Nitric acid	0	0	0	0	0	6	113.4	0	0
Phosphoric acid	0	<1	<1	0	0	<1	c	0	0
Sulfuric acid	0	<1	<1	0	0	<1	c	0	0

[a] Applies only to the incremental emissions associated with the upgrade subalternatives (RFETS non-pit subalternative and RFETS and LANL subalternative). The emissions associated with the storage of SRS plutonium in the Actinide Storage and Packaging Facility are included in the No Action emissions.

[b] Applies to both with and without RFETS and LANL Pu material.

[c] No sources of this pollutant have been identified.

[d] For some upgrades, the associated data report states the emission is NO_x. In these instances, NO_x is conservatively assumed to be NO_2.

[e] It is assumed that PM_{10} emissions are total suspended particulate emissions.

Source: DOE 1996e; FDI 1996a:1; HF DOE 1995e:1; HF DOE 1996a; IN DOE 1996a; OR MMES 1996a; PX MH 1994a; SR DOE 1994e; SRS 1996a:4.

Table F.1.3–2. Emission Rates of Pollutants for the Consolidated Plutonium Storage Facility

		NTS			Pantex		
Pollutant	**Hanford (kg/yr)**	**New Facility and Modify P-Tunnel (kg/yr)**	**New Facility (kg/yr)**	**INEL (kg/yr)**	**New Facility and Modify Zone 12 South (kg/yr)**	**New Facility (kg/yr)**	**SRS (kg/yr)**
Criteria Pollutants							
CO	520	2,500	2,300	3,400	3,700	3,300	1,600
NO_2	2,000	3,600	3,400	97,000	4,600	4,300	38,000
PM_{10}[a]	50	780	700	6,900	1,200	1,100	2,600
SO_2	34	70	62	160,000	85	79	61,000
Total suspended particulates[a]	50	780	700	6,900	1,200	1,100	2,600
Volatile organic compounds	58	370	330	400	550	500	190
Toxic/Hazardous Pollutants							
Chlorine	5	8	5	3	5	4	8
Hydrazine	<1	<1	<1	<1	<1	<1	<1
Nitric acid	6	5	6	6	6	6	6
Phosphoric acid	<1	<1	<1	<1	<1	<1	<1
Sulfuric acid	<1	<1	<1	<1	<1	<1	<1

[a] It is assumed that PM_{10} emissions are TSP emissions.

Source: DOE 1996e; NT DOE 1996a; PX DOE 1996a.

Table F.1.3–3. Emission Rates of Pollutants for the Collocated Plutonium and Highly Enriched Uranium Storage Facilities

		NTS				ORR			
Pollutant	**Hanford (kg/yr)**	**New Facility and Modify P-Tunnel (kg/yr)**	**New Facility (kg/yr)**	**INEL (kg/yr)**	**Pantex (kg/yr)**	**New Pu Storage Facility Only (kg/yr)**	**New Pu Storage Facility and Upgrade Y–12 (kg/yr)**	**New Pu and HEU Facilities (kg/yr)**	**SRS (kg/yr)**
Criteria Pollutants									
CO	520	2,800	2,500	4,000	3,800	1,900	1,900	2,100	1,700
NO_2	2,000	3,800	3,600	120,000	4,600	48,000	48,000	55,000	42,000
PM_{10}[a]	50	890	780	8,200	1,300	3,300	3,450	3,800	2,900
SO_2	34	70	66	200,000	86	79,000	79,000	90,000	69,000
Total suspended particulates[a]	50	890	780	8,200	1,300	3,300	3,300	3,800	2,900
Volatile organic compounds	58	420	370	470	570	220	220	250	200
Toxic/Hazardous Pollutants									
Chlorine	6	8	6	4	5	6	6	8	10
Nitric acid	95	5	95	95	95	6	119	95	95
Hydrazine	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hydrogen chloride	9.0	9.0	9.0	9.0	9.0	[b]	11.3	9.0	9.0
Hydrogen fluoride	9.0	9.0	9.0	9.0	9.0	[b]	11.3	9.0	9.0
Phosphoric acid	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulfuric acid	<1	<1	<1	<1	<1	<1	<1	<1	<1

[a] It is assumed that PM_{10} emissions are total suspended particulates emissions.

[b] No sources of this pollutant have been identified.

Source: DOE 1996e; DOE 1996f; NT DOE 1996a; OR MMES 1996a.

Table F.1.3–4. Emission Rates of Pollutants for the Pit Disassembly/Conversion Facility

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
Criteria Pollutants						
CO	a	a	a	a	a	a
NO_2	a	a	a	a	a	a
PM_{10}	a	a	a	a	a	a
SO_2	a	a	a	a	a	a
Total suspended particulates	a	a	a	a	a	a
Volatile organic compounds	1,500	1,500	1,500	1,500	1,500	1,500
Toxic/Hazardous Pollutants						
Cleaning solvents	750	750	750	750	750	750

[a] No sources of this pollutant have been identified. The pit disassembly/conversion process involves pure Pu materials that would not require chemical processing. The emissions estimates for the facility are based on data from similar processes at LANL's TA-55 facility. The ventilation system for the pit disassembly/conversion facility would be used specifically for contamination control and would use a large volume of air to assure contamination control. Primary confinement would be provided by a glove box system and associated zone air-handling system. There would be four stages of HEPA filters on the glovebox exhaust that would eliminate (or reduce below detection limits) a minimum of 99.95 percent of nonradioactive particulates. Radioactive particulate emissions are discussed in Section 4.3.1.9. The glovebox exhaust would be mixed with room air exhaust, which also has two stages of HEPA filters. The use of HEPA filters would not reduce VOC emissions because VOCs are not in a particulate form. There would also be process-specific scrubbers, vacuum traps, and filters that reduce the chance of criteria or toxic/hazardous pollutants releases from occurring. Because of the processing technology (which does not create some of the criteria pollutants), the defense-in-depth for Pu processing systems, and the extensive HEPA filtration (which removes the remaining criteria pollutants), emissions for criteria pollutants other than VOCs are expected to be below detection limits.

Source: LANL 1996d.

Table F.1.3–5. Emission Rates of Pollutants for the Plutonium Conversion Facility

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
Criteria Pollutants						
CO	4,000	4,000	4,000	4,000	4,000	4,000
NO_2[a]	4,500	4,500	4,500	4,500	4,500	4,500
PM_{10}[b]	12	12	12	12	12	12
SO_2	10	10	10	10	10	10
Total suspended particulates[b]	12	12	12	12	12	12
Toxic/Hazardous Pollutants						
Ammonia	10	10	10	10	10	10
Chlorine	7.5	7.5	7.5	7.5	7.5	7.5
Ethanol	20	20	20	20	20	20
Hydrogen chloride	12	12	12	12	12	12
Hydrogen fluoride	0.8	0.8	0.8	0.8	0.8	0.8
Hydrazine	<1	<1	<1	<1	<1	<1
Toxic/Hazardous Pollutants (continued)						
Nitric Acid	3	3	3	3	3	3
Phosphoric acid	<1	<1	<1	<1	<1	<1
Sulfuric acid	<1	<1	<1	<1	<1	<1
Trichloroethylene	450	450	450	450	450	450
Cleaning solvents	100	100	100	100	100	100

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are TSP emissions.
Source: LANL 1996c.

Table F.1.3-6. Emission Rates of Pollutants for the Generic Mixed Oxide Fuel Fabrication Facility

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)	Generic (kg/yr)
Criteria Pollutants							
CO	[a]	[a]	[a]	[a]	[a]	[a]	[a]
NO_2	[a]	[a]	[a]	[a]	[a]	[a]	[a]
PM_{10}	[a]	[a]	[a]	[a]	[a]	[a]	[a]
SO_2	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Total suspended particulates	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Volatile organic compounds	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Toxic/Hazardous Pollutants							
Cleaning solvents	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500

[a] No sources of this pollutant have been identified. The MOX fuel fabrication process involves pure Pu materials that would require minimal chemical processing. The emissions estimates for the facility are based on operational experience at European MOX facilities, the glovebox ventilation system design, and the actual process. Feed material preparation and fabrication of fuel pellets would be done in gloveboxes to control contamination for normal operations. The ventilation system for the MOX fuel fabrication facility would be used specifically for contamination control and would use a large volume of air to assure contamination control. There would be essentially four stages of HEPA filters on the glovebox exhaust that would eliminate (or reduce below detection limits) a minimum of 99.95 percent of nonradioactive particulates. Radioactive particulate emissions are discussed in Section 4.3.5.1.9. The glovebox exhaust would be mixed with room air exhaust, which also has two stages of HEPA filters for further filtration before release to the environment. The use of HEPA filters would not reduce VOC emissions because VOCs are not in a particulate form. There would be process-specific scrubbers, vacuum traps, and filters that reduce the chance of criteria or toxic/hazardous pollutant releases from occurring. Because of the processing technology (which does not create some of the criteria pollutants), the defense-in-depth for Pu processing systems, and the extensive HEPA filtration (which removes the remaining criteria pollutants), emissions for criteria pollutants other than VOCs are expected to be below detection limits.

Source: LANL 1996b.

Table F.1.3–7. Emission Rates of Pollutants for the Direct Disposition Alternative—Deep Borehole Complex

Pollutant	Generic[a] (kg/yr)
Criteria Pollutants	
CO	11,263
NO_2[b]	30,898
PM_{10}[c]	11,812
SO_2	2,822
Total suspended particulates[c]	11,812
Toxic/Hazardous Pollutants	
Hydrocarbons	2,831

[a] Includes the surface processing and the drilling and emplacing-borehole sealing facilities.

[b] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.

[c] It is assumed that PM_{10} emissions are total suspended particulate emissions.

Source: LLNL 1996a.

Table F.1.3–8. Emission Rates of Pollutants for the Immobilization Disposition Alternative—Ceramic Immobilization Facility and Deep Borehole Complex

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)	Generic Borehole (kg/yr)
Criteria Pollutants							
CO	32,000	32,000	32,000	32,000	32,000	32,000	11,235
NO_2[a]	9,000	9,000	9,000	9,000	9,000	9,000	31,344
PM_{10}[b]	400	400	400	400	400	400	11,340
SO_2	500	500	500	500	500	500	2,799
Total suspended particulates[b]	400	400	400	400	400	400	11,340
Volatile organic compounds	95	95	95	95	95	95	trace
Toxic/Hazardous Pollutants							
Hydrocarbons	950	950	950	950	950	950	2,806

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.

[b] It is assumed that PM_{10} emissions are TSP emissions.

Source: LLNL 1996e; LLNL 1996h.

Table F.1.3–9. Emission Rates of Pollutants for the Vitrification Alternative

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
CO	72,000	72,000	72,000	72,000	72,000	72,000
NO_2	72,000	72,000	72,000	72,000	72,000	72,000
PM_{10}[a]	573	573	573	573	573	573
SO_2	1,845	1,845	1,845	1,845	1,845	1,845
Total suspended particulates[a]	573	573	573	573	573	573
Volatile organic compounds	14,500	14,500	14,500	14,500	14,500	14,500

[a] It is assumed that PM_{10} emissions are TSP emissions.

Source: LLNL 1996c.

Table F.1.3–10. Emission Rates of Pollutants for the Ceramic Immobilization Alternative

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
CO	250,000	250,000	250,000	250,000	250,000	250,000
NO_2[a]	660,000	660,000	660,000	660,000	660,000	660,000
PM_{10}[b]	770	770	770	770	770	770
SO_2	68.0	68.0	68.0	68.0	68.0	68.0
Total suspended particulates[b]	770	770	770	770	770	770
Volatile organic compounds	81	81	81	81	81	81

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: LLNL 1996d.

Table F.1.3–11. Emission Rates of Pollutants for the Electrometallurgical Treatment Alternative

Pollutant	(kg/yr)
CO	42
NO_2[a]	191
PM_{10}[b]	15
SO_2	20
Total suspended particulates[b]	15
Volatile organic compounds	45

[a] The data report states the emission is NO_x but has been conservatively assumed to be NO_2.
[b] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: LLNL 1996b.

Table F.1.3–12. Emission Rates of Pollutants for the Existing Light Water Reactor

Pollutant	Uranium Fuel (kg/yr)[a]	MOX Fuel (kg/yr)[b]
Criteria Pollutants		
CO	40.8	40.8
NO_2	114,307	114,307
PM_{10}[c]	8,755	8,755
SO_2	85,731	85,731
Total suspended particulates[c]	8,755	8,755
Toxic/Hazardous Pollutants		
Hydrocarbons	2,223	2,223

[a] [Text deleted.] Emissions rates from the partially completed LWR are representative for existing LWRs.
[b] No increase in nonradioactive air pollutant emission is expected. During operation, concentrations of criteria and toxic/hazardous air pollutants are expected to continue to be in compliance with Federal, State, and local air quality regulations or guidelines. No additional operation or testing of diesel generators or emissions from support facilities would be expected to occur from the use of MOX fuel. Pollutant concentrations from operating an existing LWR with a MOX core rather than a uranium core would not change. The process would remain the same, because criteria and toxic/hazardous emissions are not related to the type of fuel being used (NRC 1996b:2-22).
[c] It is assumed that PM_{10} emissions are total suspended particulate emissions.
Source: ORNL 1995b; derived from TVA 1974a.

Table F.1.3–13. Emission Rates of Pollutants for the Partially Completed Light Water Reactor

Pollutant	(kg/yr)
Criteria Pollutants	
CO	40.8
NO_2	114,307
PM_{10}[a]	8,755
SO_2	85,731
Total suspended particulates[a]	8,755
Toxic/Hazardous Pollutants	
Hydrocarbons	2,223

[a] It is assumed that PM_{10} emissions are total suspended particulate emissions.

Note: Emission rates estimated for one operating unit.

Source: Derived from TVA 1974a.

Table F.1.3–14. Emission Rates of Pollutants for the Evolutionary Light Water Reactor

Pollutant	Hanford (kg/yr)	NTS (kg/yr)	INEL (kg/yr)	Pantex (kg/yr)	ORR (kg/yr)	SRS (kg/yr)
CO	<45	<45	<45	<45	<45	<45
NO_2	2,630	2,630	2,630	2,630	2,630	2,630
PM_{10}[a]	0	0	0	0	0	0
SO_2	450	450	450	450	450	450
Total suspended particulates[a]	0	0	0	0	0	0

[a] It is assumed that PM_{10} emissions are total suspended particulates emissions.

Source: LLNL 1996g.

F.2 NOISE

This section summarizes local noise regulations and presents available sound level monitoring data for the sites. A discussion of operation noise sources and the potential for noise impacts is provided in PEIS Chapter 3, Affected Environment, and Chapter 4, Environmental Consequences. Any further analysis of operation noise impacts, including traffic noise impacts and impacts from outside sources, has been deferred to the tiered, site-specific *National Environmental Policy Act* documents.

The Occupational Safety and Health Administration standards for occupational noise exposure (29 CFR 1910.95) are applicable for worker protection at each site.

F.2.1 HANFORD SITE

Studies of noise at Hanford are discussed in Chapter 3 and in detail in *Hanford Site National Environmental Policy Act Characterization* (PNL-6415 Rev. 6, August 1994).

The State of Washington Department of Ecology has adopted regulations in Washington Administrative Code 173-60 through 173-70 which limit environmental noise levels. Maximum noise levels are defined for zoning of an area in accordance with Environmental Designation for Noise Abatement (EDNA). The Hanford Site is classified as a Class C EDNA on the basis of industrial activities. Unoccupied areas are also classified as Class C areas by default because they are neither Class A (residential) nor Class B (commercial). Maximum noise levels are established based on the EDNA classification of the receiving area and the source area (Table F.2.1–1) (HF PNL 1994a:4.144).

Table F.2.1–1. Applicable State Noise Limitations for Hanford Site Based on Source and Receptor Environmental Designation for Noise Abatement (dBA)

Source Hanford Site	Receptor		
	Class A Residential	Class B Commercial	Class C Industrial
Class C - Day	60	65	70
Class C - Night	50	-	-

Source: HF PNL 1994a.

F.2.2 NEVADA TEST SITE

No environmental noise survey data are available for NTS. The State of Nevada and Nye County have not established any regulations that specify acceptable community noise levels with the exception of general prohibitions on nuisance noise.

F.2.3 IDAHO NATIONAL ENGINEERING LABORATORY

Studies of noise at INEL are limited primarily to noise measurements along roadways. These are discussed in Chapter 3 and in *NPR Environmental Impacts at the INEL: Air Quality, Cooling Towers, and Noise* (NPRD-90-059). The State of Idaho and the counties in which the INEL is located have not established any regulations that specify acceptable community noise levels, with the exception of general prohibitions on nuisance noise.

F.2.4 PANTEX PLANT

A study of sound levels near Pantex consists of data collected along roads for short periods of time during peak traffic and for specific noise events at Pantex. Neither the State of Texas nor the local government have established regulations that specify acceptable sound levels applicable to Pantex, with the exception of general prohibitions on nuisance noise.

F.2.5 OAK RIDGE RESERVATION

Sound level measurements have been recorded at various locations within and near ORR as discussed in Chapter 3 and documented by Cleaves (ORR 1991a:2) and Knazovich (ORR 1991a:6). Maximum allowable noise limits for the city of Oak Ridge are presented in Table F.2.5–1.

Table F.2.5–1. City of Oak Ridge Maximum Allowable Noise Limits Applicable to Oak Ridge Reservation

Adjacent Use	Where Measured	Maximum Sound Level (dBA)
All residential districts	Common lot line	50
Neighborhood business district	Common lot line	55
General business district	Common lot line	60
Industrial district	Common lot line	65
Major street	Street lot line	75
Secondary residential street	Street lot line	60

Note: dBA=decibel A-weighted.
Source: OR City 1985a.

F.2.6 SAVANNAH RIVER SITE

Ambient sound level data collected at SRS in 1989 and 1990 are summarized in *Sound-Level Characterization of the Savannah River Site* (NUS-5251). The States of Georgia and South Carolina, and the counties where SRS is located, have not yet established noise regulations that specify acceptable community noise levels except for a provision of the Aiken County Nuisance Ordinance that limits daytime and nighttime noise by frequency band (Table F.2.6–1).

Table F.2.6–1. Aiken County Maximum Allowable Noise Levels[a]

Frequency Band (Hz)	Nighttime Sound Pressure Levels[b] Nonresidential Lot Line (dB)	Nighttime Sound Pressure Levels[b] Residential Lot Line (dB)
20-75	69	65
75-150	60	50
150-300	56	43
300-600	51	38
600-1,200	42	33
1,200- 2,400	40	30
2,400-4,800	38	28
4,800-10,000	35	20

[a] Daytime (7:00 a.m. - 9:00 p.m.) sound pressure levels: apply one of the following corrections (dB) to the nighttime levels above: daytime operation only, +5; source operates less than 20 percent of any 1-hour period, +5; source operates less than 5 percent of any 1-hour period, +10; source operates less than 1 percent of any 1-hour period, +15; noise of impulsive character, -5; noise of periodic character, -5.

[b] For the purpose of this ordinance, nighttime is the period 9:00 p.m. to 7:00 a.m.

Note: dB=decibel.

Source: SR County 1991a.

F.2.7 ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

No sound level measurements have been made in the area near RFETS. Neither the State of Colorado nor the local government have established regulations that specify acceptable sound levels applicable to RFETS, with the exception of general prohibitions on nuisance noise.

F.2.8 LOS ALAMOS NATIONAL LABORATORY

No environmental noise survey data are available for LANL. The State of New Mexico has not established any regulation that specifies acceptable community noise levels with the exception of general prohibitions on nuisance noise.

Los Alamos County has adopted a noise ordinance that specifies maximum sound levels in residential areas. Sound levels at a residential property line are limited to 65 decibel A-weighted (dBA) during the hours 7 a.m. to 9 p.m., and to 53 dBA during the hours 9 p.m. to 7 a.m. The 65 dBA limit may be exceeded by up to 10 dBA for up to 10 minutes of any hour between 7 a.m. and 9 p.m.